

Focus: Aerospace Integration

Going Boldly—Where?

Aerospace Integration, the Space Commission, and the Air Force's Vision for Space

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Editorial Abstract: Aerospace Power Journal has regularly showcased discourse over the functional and organizational relationship between air and space. The future of air and space integration or separation is the subject of the congressionally mandated Space Commission, whose final report was released in January 2001. Dr. Mueller and Colonel Hays observe inconsistencies in the Air Force's approach to aerospace integration that may accommodate that service's bureaucracy but be perceived as "poor stewardship" of space.

AS WITH MOST other new technologies and frontiers, our perceptions of outer space and space technology have been fundamentally shaped by competition and warfare. World War II was the rationale for Nazi Germany's equivalent of the "Manhattan Project," led by Wernher von Braun, which first brushed the edge of space in 1942 with the revolutionary V-2 (A-4) ballistic missile.¹ Likewise, the superpower competition during the cold war was the most influential factor in shaping both the Soviets' opening of the space age with the launch of *Sputnik I* on 4 October 1957 and the eventual American response of initiating a race to the Moon.² From the beginning, the interrelationships between

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space and national security have been complex and controversial. Today—due to the end of the cold war, the absence of competition from military peers (at least for the near term), space's role in enabling the information revolution, and the blurring of lines between traditional space sectors caused by the growth of commercial space activities—space issues are more complex, multidimensional, and controversial than ever. One of the most significant implications of these developments is that it is no longer clear that the relationship between space and national security is, or should be, shaped primarily by international military competition. What, then, is the relationship between space and national security? What should guide our vision for space, and how should we organize to implement it?

Due to its sweeping charter and powerful members, the Commission to Assess United States National Security Space Management and Organization was the most important, and potentially influential, group ever formed to examine these broad issues.³ The Space Commission was the brainchild of Sen. Bob Smith (R-N.H.); it was established by the fiscal year 2000 National Defense Authorization Act, first met on 11 July 2000, and delivered on schedule its final report to Congress and the secretary of defense in January 2001. The Air Force, as the largest military player in space, is clearly the organization that the Space Commission studied most carefully.⁴ Moreover, because Senator Smith and several members of the commission have repeatedly criticized the Air Force's overall stewardship of space to date, it is no secret that the commission was established, in large part, to challenge the status quo in military space. Indeed, the very creation of the commission was an implicit critique of the Air Force's vision for space.

Meanwhile, the Air Force has recently refocused on the concept of aerospace—a concept that defines air and space as a seamless operational medium and that strongly implies two things: the Air Force should be the lead service in this operational medium, and it should seek to control and apply force from

this medium. The Air Force's vision statement of June 2000, *Global Vigilance, Reach & Power: America's Air Force Vision 2020*, emphasizes aerospace integration (AI) or the blending of air and space capabilities and personnel to advance aerospace power, regardless of where the platforms are located or which ones are chosen.⁵ The Space Commission and the start of a new presidential administration create an excellent opportunity to reexamine the utility of the aerospace concept and AI in providing a vision for the Air Force's future in space.

This article reviews the evolution of arguments about the relationship between space and national security and examines what space means for the future of the Air Force. It looks first at the roots and evolution of the aerospace concept and evaluates its influence on the way the Air Force thinks about space and develops space doctrine. Next, it examines enduring military space issues and evaluates how well AI serves the Air Force in addressing these important questions. Finally, it offers recommendations to strengthen the Air Force's vision for space.

Roots and Implications of the Aerospace Concept

Conceptually, the roots of the aerospace concept are closely associated with airpower theory and run quite deep. In practice, however, both the word and the concept of aerospace have proven to be controversial, confusing, mired in bureaucratic politics and interservice rivalry, and—worst of all—detrimental to the development of more robust space-power theory.⁶ Today's airmen can be forgiven if they don't know very much about the controversies associated with the aerospace concept because the Air Force has tended to sweep many of them under the rug. A bureaucratic politics-oriented approach has obvious appeal for the Air Force at a time when it faces strong external pressure such as the Space Commission represented, but such an approach is certainly no way to build a robust vision for space power.

Airmen have been at the forefront of thinking about the military uses of space, but, unfortunately, we still have a long way to go on the road to developing mature space-power theory. At least as far back as 1945, in Gen Henry "Hap" Arnold's visionary "Third Report to the Secretary of War" and Dr. Theodore von Kármán's *Toward New Horizons* study, space was seen as a natural extension of core Army Air Forces doctrine and a potential means of "flying" higher, farther, and faster to conduct long-range strategic-attack missions.⁷ RAND's very first report, *Preliminary Design of an Experimental World-Circling Spaceship*, issued in 1946, was even more prescient because it laid out the engineering challenges and conceptual utility for almost all types of military space systems that have been built to date.⁸

Airmen also have been thinking about the relationship between the mediums of air and space for a long time. Air Force chief of staff Gen Thomas D. White first used the word *aerospace* in 1958, and the concept that air and space form a seamless operational medium has been the foundational component of Air Force thinking about space ever since. From the Air Force's perspective, the roots and development of the aerospace concept seem an innocent and natural evolution from air-power theory.⁹ Outside the Air Force, however, the aerospace concept and its implication that the Air Force should be the lead service for this boundless new medium were often viewed by individuals in the other services and within the Office of the Secretary of Defense (OSD) as an unabashed "land grab." The other services and OSD have never accepted the Air Force's definition of aerospace and certainly have not ceded all operations within this realm to the Air Force. The aerospace concept has also, at times, led the Air Force into seemingly inconsistent positions, such as when it joined with the Navy during 1997 to oppose the proposal by Howell Estes, commander in chief of US Space Command (CINCSpace), that space be designated as a separate area of responsibility within the Unified Command Plan.¹⁰ Perhaps the best illustration of the Department of Defense's (DOD)

lack of consensus, or even dialogue, on the Air Force's concept of aerospace is the fact that the word does not even appear in DOD's July 1999 directive entitled *Space Policy*.¹¹

Moreover, because the Air Force argued that it should seek to control and apply force from space just as from the air, the aerospace concept inevitably came into conflict with the Eisenhower administration's "space for peaceful purposes" policy. That administration saw the aerospace concept (and any other discussion of overtly military activity in space) as antithetical to its secret but highest-priority space policy as established by National Security Council Resolution 5520 in May 1955. This policy called for the United States to use the civilian face of its International Geophysical Year scientific satellite program as a "stalking horse" to establish a legal regime to legitimize overflight and thereby open up the closed Soviet state to satellite reconnaissance by the secret WS-117L spysat system.¹² Eisenhower's space-for-peaceful-purposes policy, along with his distrust of the military, also led to the establishment of the National Reconnaissance Office (NRO), America's secret and independent space agency, whose existence was not officially revealed until 1992. In sum, the aerospace concept was repeatedly thwarted in its early years, both secretly (via the creation of the NRO) and publicly (as reflected in the string of cancelled Air Force efforts to develop systems for aerospace operations such as the Dyna-Soar space plane and the Manned Orbiting Laboratory).¹³

Given this controversial and obscured early history, it is hardly surprising that the aerospace concept was not a very firm foundation for developing space-power theory. The aerospace concept attempted to define a new, seamless operational medium but did not provide a powerful rationale with which to address fundamental issues such as what the Air Force should do in space, how it should do it, or why. It certainly did not provide a rationale strong enough to overturn the basic tenets of Eisenhower's vision. And it clearly did not help that, in its doctrine manuals up until the 1980s, the Air Force simply

substituted the word *aerospace* for *air* and inappropriately ascribed attributes such as speed, range, and flexibility to space forces.¹⁴

Fortunately, many of the problems with the aerospace concept and the development of space-power theory and doctrine have already been thoughtfully addressed in this journal over the years. Dennis Drew, Charles Frieden-stein, and Kenneth Myers and John Tockston published three of the best analyses during the 1980s.¹⁵ These interrelated articles build on Drew's doctrine-tree model—the idea that doctrine should grow out of the soil of history, develop a sturdy trunk of fundamental doctrine, branch out into doctrine for specific environments, and only then attempt to sprout the organizational doctrine analogous to “leaves.” This approach provides a comprehensive way to examine the aerospace concept and the Air Force's first official space doctrine, Air Force Manual (AFM) 1-6, *Military Space Doctrine*, released in 1982.¹⁶ Frieden-stein finds that “there is no doctrinal foundation for the term *aerospace*” (emphasis in original) and critiques the Air Force for attempting to produce “leaves on a nonexistent branch” because it had not developed environmental doctrine before issuing the organizational doctrine in AFM 1-6.¹⁷ Myers and Tockston strongly critiqued the Air Force's tendency to “force-fit” space doctrine into the mold of air doctrine and argued that the three major characteristics of space forces are in fact emplacement, pervasiveness, and timeliness.¹⁸

Unfortunately, the weaknesses of the aerospace concept clearly identified by the 1980s (if not earlier) continued to pervade Air Force thinking about space into the 1990s and still contribute to our cloudy and inconsistent vision. But, in a major departure, for the greater part of the 1990s, the Air Force abandoned aerospace both conceptually and semantically. Air Force chief of staff Gen Merrill McPeak emphasized the importance of space assets in enhancing the combat effectiveness of coalition forces during the Gulf War by labeling the conflict “the first space war” and then changed the Air Force mission statement in June 1992 by adding the words

air and space.¹⁹ According to Gen Thomas Moorman, McPeak's vice chief of staff, with this change “Air Force space operations were formally legitimized and placed conceptually on an equal footing with air operations.”²⁰

Shortly thereafter, in its *Global Engagement* vision statement of November 1996, the Air Force issued what is probably its most strident position ever regarding the importance of space to the Air Force's future: “We are now transitioning from an *air* force to an *air and space* force on an evolutionary path to a *space and air* force” (emphasis in original).²¹ Although this statement excited space enthusiasts in Colorado Springs and elsewhere, it begged the question of what types of space missions would justify such a major evolution, and, overall, it raised more issues than it resolved. Many saw it as a divisive vision because it clearly seemed to promote space separatism without providing much guidance concerning critical issues such as the rationale or timing for the Air Force's evolution to a space and air force. Indeed, *Global Engagement* and even United States Space Command's (USSPACE-COM) *Long Range Plan* of March 1998 still suffered from underdeveloped fundamental and environmental doctrine for space and still failed to provide persuasive answers to the basic questions of what the Air Force should do in space, how it should do it, and why.

Recognizing these difficulties, Air Force chief of staff Gen Michael Ryan created the Aerospace Integration Task Force in the spring of 1998, tasking it to look in particular at the wisdom of continuing to use the separate “air and space” construct. The Air Force's white paper of May 2000 (*The Aerospace Force*) and its vision statement of June 2000 (*Global Vigilance, Reach & Power*) are the fruit of this effort and take us full circle to the aerospace concept with their emphasis on AI. Of course, space enthusiasts may perceive the Air Force to be backsliding on the importance of space to its future in its latest vision statements. And, ironically, due to the Air Force's movement away from aerospace in the early 1990s and the timing of their release, these statements may actually have given more ammuni-

tion to Air Force critics on the Space Commission.²²

Unresolved Debates and Premature Questions

Participants on all sides of the debate between AI and space separatism invoke the physics of space and spaceflight to bolster their arguments, implying that the fight can be resolved through the application of indisputable scientific laws. Integration proponents correctly observe that no clear demarcation exists between air and space, pointing out that some true aerospace vehicles will exist in the future, but overlook the fact that the boundaries between other realms are also indistinct—ask the pilot who flies an air-cushion vehicle or a wing-in-ground-effect craft.²³ Their opponents cite the vast differences between aircraft and satellite operations, but these alone will never justify the establishment of a separate space force by a country that has found it sensible to include aircraft in its army and navy.²⁴ In the end, such debates cannot provide the answers to questions that are essentially strategic and political.

Too much of the recent debate over the future of US military space operations has centered on how the United States ought to organize and manage this realm of activity. This is perhaps not surprising, given Americans' penchant for quick fixes and the organizational dimension of the Space Commission's mandate, but it is unfortunate, for it places the cart squarely before the horse. In order to identify the best answer to the question of organization, our nation should first address a set of sweeping strategic issues regarding the nature and relationship of space and national security. Then and only then can the focus usefully turn to the question of organization. In other words, it is impossible to know how best to organize until you know what you want to do. Even setting aside the uncertainties that always come with looking far into the future—for these must be set aside in order to conduct long-term planning—having a reasonable sense of the probable relationship

among space, national security, and US grand strategy in coming decades depends upon making assessments of several factors that remain very much open to debate.

Unfortunately, the aerospace concept and AI are not sufficiently developed to provide much help in identifying the most important underlying questions, let alone addressing them. A more useful vision would provide far more guidance in this area. Among these fundamental and unresolved issues, the three that loom largest in current discussions of space power are the desirability and inevitability of space weaponization, the implications of the growing commercial importance of space, and the relationship between space and information operations in national security.

Space Weaponization

The most incendiary debates about space policy relate to the placement of weapons in space, particularly whether space weaponization is desirable for the United States and whether it is inevitable. A wide range of opinions exists with respect to the first of these issues.²⁵ Some advocates of space weaponization are extreme "space hawks," favoring the all-out pursuit of US dominance of space, which they often describe as the ultimate high ground. According to Senator Smith, for example, the concerted development of American space weapons "will buy generations of security that all the ships, tanks, and airplanes in the world will not provide. . . . Without it, we will become vulnerable beyond our worst fears."²⁶ In short, if the United States moves expeditiously to take advantage of its existing leadership in space technology and establish an unassailable dominance of orbital space, its position as the preeminent world power will be enhanced and perpetuated; if, on the other hand, it fails to seize the opportunity to establish unassailable superiority in space, its world leadership will be threatened by more visionary rivals.

Other proponents of weaponization predict less extravagant benefits from space weapons and are less sanguine about how un-

challengeable US space dominance really would be. Instead, they emphasize the importance of space control and the role of space as a vital future arena of military competition, though not necessarily the dominant one. Rather than foreseeing the wholesale replacement of airpower with space-to-Earth weapons, these theorists principally base their arguments for space-weapons development on the need to protect growing US interests in space and to prevent enemies from using space systems against the United States or its armed forces. Yet, this perspective, too, is based upon the fundamental premise that he who controls space will control the world—or at least he who doesn't, won't—and, thus, the more the United States invests in developing its space power, the more powerful and secure it will be.²⁷

On the other side of the weaponization debate is a variety of perspectives that favor the preservation of space as a weapons-free “sanctuary.” Some sanctuary proponents see space weaponization as fundamentally bad because they wish to avoid any expansion of military competition into domains where it had previously been absent, based on general principles of morality, arms control, or conflict resolution. Others oppose the weaponization of space in particular because they believe that the nature of space-based weapons would generate instability due to the incentives for preemptive attack that powerful but vulnerable weapon systems seem likely to create.²⁸ Although adherents to these perspectives are scarce within the ranks of the US Air Force, they are less so among national and foreign policy makers; thus, these beliefs remain a powerful force in US space policy.

An alternative, realist version of sanctuary theory also exists, though it is often overlooked by those who write off the sanctuary perspective as idealistic and naïve peacemongering. Theorists in this camp oppose space weaponization not on the grounds that it would be harmful on a global level, but because they believe it would reduce rather than enhance US power and security in particular.²⁹ They argue that the United States, as

the leading user of space, has by far the most to lose if space systems become increasingly vulnerable to attack and that as the world's preeminent air and surface power, it has the least to gain from developing such weapons. Sanctuary realists also assert that if the United States takes the lead in developing space weapons, it will be easier for other states to follow suit, thanks to US technological trailblazing. Finally, they tend to be skeptical that the military utility of space weapons, both for power projection and to protect US space assets, will be as great as weaponization proponents typically claim.³⁰

The question of whether the United States should—and will—lead the world into placing weapons in space or work to maintain and perpetuate the informal sanctuary status of space remains very much unresolved. This is not surprising, for many of the technologies involved are still immature, making it difficult to assess how useful space weapons would in fact be. Moreover, because of the current lack of conventional military threats to the United States, delaying a final decision on this issue for some years seems quite reasonable. However, this uncertainty makes it impossible to declare that any organizational plan for US space forces will be ideal for the long term, since whether—and, if so, how—space is to be weaponized should fundamentally shape the organizations that will execute national space policy.

Of course, US preferences regarding space weaponization might not matter to the organizational question if weaponization is inevitably going to occur, regardless of whether it is desirable, and if the pace and nature of other states' decisions about weaponizing space are not affected by the actions or inactions of the United States. This is a suggestion made by many theorists, including several former CINCSPACEs³¹ and is frequently invoked as a key reason to press ahead on the path to weaponization. However, the argument that weapons eventually go anywhere that people do is too simplistic to provide much insight about the ways in which space might actually become weaponized. Space is only the fourth

genuinely new environment into which human activity has spread (the others being the maritime, aerial, and submarine worlds), and the fact that something has happened three times before hardly proves the existence of a timeless law of nature. Moreover, the spread of weapons into these three domains occurred very differently: at sea, navies gradually appeared to control piracy and transport armies; weaponization of the air occurred very soon after the first flights, mainly driven by the need to defend against observation aircraft and then to escort them; while submarines were initially created as weapons to use against nonsubmersible targets, and to this day, military operations in the undersea arena vastly dominate civil and commercial activities there. In light of this diversity of experience, the assumption that there is a consistent, predictable pattern to the militarization of new and different environments simply does not hold water (or air).

But what about the similarities between the exploitation of air and space, so often mentioned by Air Force leaders? On the surface, these appear compelling, at least to the extent that reconnaissance was initially the most important military mission performed in both realms; in fact, reconnaissance was the most important application of US airpower for many decades, until satellites began to take over the mission.³² Bombers greatly outnumbered reconnaissance aircraft in World War II air forces not because bombing was more important but because even a small number of aerial observation platforms was sufficient to transform warfare, while many bombers were required to have much effect. Yet, the very fact that space is not weaponized today demonstrates that air and space have followed divergent evolutionary paths. This becomes even clearer if one recalls that "space weapons" such as the US nuclear-tipped Program 505 and 437 antisatellite (ASAT) systems or the Soviet Fractional Orbital Bombardment System and co-orbital ASAT system were actually deployed to a limited extent beginning in the 1960s but that no such dedicated systems are deployed today—

a retreat from space weaponization without precedent in airpower history.³³

Other similarities between the development of air and space operations will surely arise in the years to come, but there is very little basis for assuming that examining the history of airpower will reveal more than some vague hints of what might—or might not—happen in space. At a minimum, these shaky analogies do not absolve strategists and policy makers from the responsibility of deciding not only whether space is destined in its own right for weaponization, but also what role the United States should play in shaping the environment in which these decisions will be made.

Space Commerce

In much the same way, the implications of the profound, ongoing boom in the commercial use of space cannot be deduced from the history of the development of maritime and air commerce. It is vitally important to understand that commercial space activities are fundamentally different from merchant shipping and air transport in every respect, save that all three are economically important. Today, once on orbit, *all* significant space commerce involves information—either its collection and transmission, or both. In contrast, virtually all commercial shipping and most commercial aviation involve the movement (or the collection, in fishing) of goods and passengers. This distinction between information and transportation is also evident in space's role in providing "global utilities" such as Global Positioning System (GPS) timing signals. As a result, the commercial space revolution has less in common with the rise of the steamship or the airliner than with the invention of telegraphy or radio.³⁴

This difference has several important implications for space power. First, it fundamentally alters the sorts of threats that might be anticipated against commercial space systems. Traditional piracy, for example, is out; commerce raiding is a possibility; and destructive terrorist attacks (probably by states) may be a serious threat. Satellites, however,

are likely to be a more difficult and thus less attractive target set for direct attack under most circumstances than are other components of space systems, such as launch facilities or ground-control stations, and if they are attacked, it will most likely be through indirect means such as communications jamming.³⁵

Second, it means that the menu of options for deterrence and defense against such threats is very different for space systems than for air and sea commerce. Because satellites convey information, their vulnerability to attack can in many cases be eliminated through the development of distributed and redundant capabilities—something that the advent of the microsat should make vastly more practical.³⁶ This may be far more efficient than trying to protect space systems by using body-guard satellites or other space weapons (which would probably be useless against directed-energy attacks in any event). Navies developed largely because this option is not available for maritime commerce since the same merchandise or passengers cannot travel on several vessels simultaneously, and since there are severe practical limits to the extent to which a state's trade can be divided among a larger number of smaller merchant ships.

Finally, due to the novelty and the highly dynamic nature of space commerce, we believe it is too early to assess with confidence the implications of these developments or to base significant changes in space policy or organization on what has happened so far. In the wake of the Iridium system's bankruptcy and a host of other cancellations or delays, commercial satellite operators and their backers are giving greater scrutiny than ever to their projected bottom line and are certainly not clamoring for military protection or even discussing hardening standards or other measures that might interfere with their potential profitability. In the end, the United States may want its military to play an important role in operating and protecting global utilities, but it is far from clear that either economists or strategists fully understand the

emergence and trajectory of the commercial markets that have risen out of military innovations such as the Advanced Research Projects Agency Network (ARPANET) or the GPS system.

In light of these factors, space strategists should resist the temptation to engage in easy but fallacious generalizations about the equivalence of maritime trade and commercial space operations, or the need to escort commercial satellites as if they were merchant ships at sea.³⁷ In fact, greater attention to the air-space analogy might be helpful in this area, for the Air Force does not routinely make a practice of escorting US commercial airliners, even though they are economically important and entirely vulnerable to attack. It is already clear that better mechanisms for space surveillance, space traffic control, and attack characterization are needed. Beyond this, serious consideration of the sorts of threats that space systems may face, and under what circumstances, is required, followed by an assessment of how best to provide security against these threats—perhaps but not necessarily including defense—for space *is* different. This assessment in turn will furnish considerable guidance in designing or tasking appropriate organizations to accomplish this.

However, even this discussion only just begins to reflect how significant the commercial space revolution—and the information revolution of which it is a part—will be to global politics and military strategy in the future. These developments also seriously undermine the strategic tenets of Eisenhower's vision of space for peaceful purposes that led to the creation of the NRO. Under the Land Remote Sensing Policy Act of 1992 and Presidential Decision Directive 23 of March 1994, it is now the policy of the United States to create incentives to develop a high-resolution *commercial* remote-sensing industry. At a minimum, readers should consider how stability considerations and military operations will need to change under the conditions of global transparency these new systems will create.³⁸

Space and Information

In order to decide how best to organize US military space operations, it will also be necessary to resolve the question of the relationship between space and information power. Because space operations are principally directed toward information collection and transmission—and this will probably remain true even if space is weaponized—it is reasonable to think that the same organizations that operate space-based reconnaissance and communications systems ought to be responsible for other types of platforms that perform the same missions. Indeed, there has already been some movement toward transforming USSPACECOM into a Space and Information Command by giving it DOD's computer network attack (CNA) and computer network defense (CND) missions.³⁹

Whether or not such a course is to be followed to its logical conclusions will obviously have enormous implications for making choices about military space organization. If the same entity is responsible for manned aircraft, unmanned aerial vehicles, and satellites that conduct reconnaissance, as well as for both space communications and CNA and CND, its structure and culture will be very different from those of an organization exclusively devoted to space operations. Addressing this issue will be complicated by the fact that it must involve not only space functions performed today by the armed services, but also the functions of the NRO and other organizations. Realigning the relationship between the military and nonmilitary components of the larger national security space arena would be a major undertaking. However, it is difficult to see how one can make any serious case for the need to consolidate military space operations either as or within a single service without engaging this question.

Aerospace Integration: An Unsatisfying Vision

Even if there were consensus on the critical strategic issues that must underpin a

sound strategy for US space power, AI in its current form falls far short of offering the sort of organizational vision likely to have impressed either the Space Commission or the American public. This is clearly illustrated by a number of recent arguments in the pages of this journal.

Before examining some of the shortcomings of AI as an organizational prescription, however, it is important to note that the *philosophy* of AI is genuinely compelling. As the military importance of space has grown in both potential and reality, the close integration of air and space power in theory, doctrine, and operations becomes ever more important.⁴⁰ The same is true of integrating land and sea with space power, of course; moreover, integrating air, land, and sea power is also more important than ever, as the speed, range, and complexity of military operations in each of these environments increase. The relationship between air and space may be unique among these—indeed, we strongly believe that it is—but if few skeptics are persuaded of this by the Air Force's current approach to AI, it should come as no surprise.

Cloudy Vision

Perhaps the most obvious, if not the most serious, shortcoming of the AI organizational vision is that it has so little theoretical content. Why the Air Force believes that US military space capabilities should be concentrated in its hands remains surprisingly unclear, considering that this is the principal theme of AI advocacy. Since integration with space is essential for all the armed services, AI proponents must make a strong case both that integration works best within a single service and that the Air Force's need to be close to its space assets is greater than that of the Army or Navy. But if interservice boundaries really are such a serious obstacle to functional integration, AI cannot possibly look attractive to the other armed services, for space support from the Air Force would probably be even less responsive than support from an independent organization for which space

support to others would be most of its *raison d'être*.

Moreover, some of the prominent arguments that the Air Force's space interests are inherently greater than those of others are distinctly unimpressive.⁴¹ One of the most glaring illustrations of the latter problem appears in two articles advocating AI that recently appeared side by side in *Aerospace Power Journal*, both with authors who played leading roles in the Air Force's Aerospace Integration Task Force. Maj Gen John Barry and Col Darrell Herriges argue for centralizing US space assets in the hands of the Air Force because of the likelihood of space weaponization, while allowing that proposals to create a separate Space Force might be valid if military space operations were limited to supporting other military operations.⁴² Ralph Millsap and Dr. D. B. Posey make the opposite case for the same policy, however, arguing that it is the Air Force that can most efficiently provide space support for terrestrial operations but stating that "when military operations become concerned with effects in space, then they may warrant the establishment of a Space Force."⁴³ If AI advocacy is based on such divergent premises, it seems likely that many critics will perceive it as little more than a stratagem to preserve the Air Force's organizational turf.

Been There, Done That

More disturbing than the internal inconsistencies in the AI vision are the overt and subtle ways in which it may promote strategic conservatism in thinking about space power. Not surprisingly, Senator Smith has taken the lead in openly critiquing the Air Force's vision for space and the conservative, air-centric thinking he believes it produces:

Even the Air Force's Space Warfare Center and Space Battlelab are focused primarily on figuring out how to use space systems to put information into the cockpit in order to drop *bombs* from *aircraft* more accurately.

This is not space warfare. It is using space to support air warfare. . . .

. . . if this is all there is to aerospace, then it is a woefully deficient concept. It is not space power. (Emphasis in original)⁴⁴

Although there is a kernel of truth in Senator Smith's arguments, we believe his case is overstated, given today's political, fiscal, and technical realities. Even more telling is the fact that few, if any, uniformed officers are willing to make this case so strongly in public. In fact, perhaps as the result of Smith's assertions, the Air Force now seems quite concerned about the breadth of its vision for space. According to Gen Ralph E. Eberhart, the current CINCSpace, "I don't think we would be good stewards of space capabilities if we only thought about 'integration.' We also need to be spending resources and intellectual capital on space control and space superiority."⁴⁵

The AI vision does allow for the possibility that space will become more than a supporting arm, with some airpower missions migrating primarily—or even completely—to space systems. However, the missions and functions that it considers are essentially limited to those that the Air Force performs today. Whether airpower or space power takes the lead, what is being done is something that airpower used to do alone or—as in the case of space superiority—is a familiar airpower mission simply projected onto the darker canvas of space. More importantly, however, all of this discussion necessarily refocuses our attention on the Air Force's plan for how we get from here to there—the primary purpose of a vision statement—and highlights the weaknesses of AI in this regard.

To a considerable extent, of course, any argument that claims through false analogies that the military use of space will inevitably recapitulate earlier experiences with the sea or the air encourages conservative strategic thinking. Rarely if ever does one find AI advocates acknowledging the possibility that space power may involve wholly new missions or that it may call for a fundamentally different set of strategic categories. However, this reluctance to consider that space activity might evolve in unprecedented ways is at least

as common among air and space separatists as it is in the arguments of aerospace integrationists. This does not mean that AI will strangle innovation in Air Force thinking about space power, but if real innovation does occur, it is more likely to come in spite of the AI movement than because of it.

Space Isn't Just Black and White

One of the most surprising aspects of the AI debate is that both its proponents and the advocates of a separate space force or corps are so quick to assume that military space assets ought to be centralized in a single organization. After all, US national security space assets are currently divided between the Air Force and the NRO, and whether or not this arrangement is ideal, it is certainly one that both parties have accepted with little public complaint for many years.

This tendency is particularly visible in the debate surrounding the most innovative concept for future US space organization to appear in some years—Lt Col Cynthia McKinley's recent *Aerospace Power Journal* article titled "The Guardians of Space."⁴⁶ In a strikingly original proposal, McKinley advocates using economic criteria to separate the direct war-fighting and support functions currently performed by US military space assets, retaining the former in the Air Force while making the latter into a United States Space Guard closely based on the organizational model of the US Coast Guard.⁴⁷ This new organization would fall under the management of the Department of Transportation in peacetime and revert to Air Force control during war or national emergency. McKinley's suggestion in many ways is crafted to promote AI and would remove from the Air Force a number of current functions (such as operating the GPS satellite constellation) for which the service seems to have only limited enthusiasm.

Whether or not McKinley's specific proposal is a good idea—and it does have at least as much to recommend it as do the organizational options that the Space Commission's charter called for it to consider—it reminds us how important the development of the

commercial aviation sector was to early airpower theorists such as Billy Mitchell. It also points out that those who simply assume that military space assets must be combined in a single service or organized in ways similar to existing military structures are not looking beyond a very narrow spectrum of choice. It is possible that centralization of military space will promote the most rapid innovation and development of US space power (whatever that turns out to look like), but it is at least equally plausible to suggest that healthy competition among rival organizations will be far more effective at achieving this goal.⁴⁸ It is worth noting that AI advocates do not typically argue that the division of US military aviation among multiple services has retarded the development of American *airpower* thought and employment.

Conclusions and Recommendations

Our first recommendation is for the Air Force to acknowledge the considerable limitations of the aerospace concept and AI. As discussed above, despite many years of effort, these concepts simply are not theoretically rigorous enough to bear much weight. They are clearly far more attractive within the Air Force than outside it, and they don't necessarily do very much to advance space's contributions to national security. Simply put, they are not visionary. The idea of aerospace may have been forward looking when it was advanced in 1958, but the Air Force has developed few actual capabilities along the lines originally envisioned, and it is difficult to see many areas where the concept subsequently had much influence. Likewise, in its present form, AI seems to place much more emphasis on how space can contribute to today's war-fighting capabilities than on how space can enhance future national security.

Contrasting Billy Mitchell's comprehensive vision of the United States as an airpower nation in *Winged Defense* or the Air Corps Tactical School's (ACTS) vision for strategic bombing in the 1930s with whatever guidance

AI provides concerning space and future national security emphasizes just how little vision is contained in AI.⁴⁹ To be sure, Mitchell and the ACTS did not always get things right, which only reinforces how important it now is to foster open and rigorous debate concerning space's role in the future of the Air Force and the nation. Current policy restrictions and a lack of civilian guidance should not be allowed to stifle innovative thinking about the nature, possibilities, and limitations of space power. Amidst the changing international environment, the increasing military utility of space, and the emerging importance of information operations, these are debates concerning the very soul of the Air Force—they are inevitable and overdue.

Second, revisiting the background of this issue convinces us of the need for greater rigor and consistency in the development of Air Force vision statements. Vision statements should illuminate a path to a desired future state by providing general, long-term guidance. They can do this only if they are clear and consistent. Rigor in developing vision statements helps to ensure that they are comprehensive, supportable, and do not need to be changed very often. The two most recent Air Force vision statements clearly fail these basic tests: only about three-and-a-half years elapsed between the releases of *Global Engagement* and *Global Vigilance, Reach & Power*; yet these consecutive statements represent starkly different visions of space versus aerospace and disagree about the importance of space in the Air Force's future. Imperfect but durable vision statements that merely get it less wrong than our potential adversaries (to use Michael Howard's phrase) are preferable to churning out new vision statements with every change in senior leadership.

Third, if the Air Force is serious about fostering innovative approaches to national security space issues, it must carefully address the human dimension of this problem. People provide the leadership required to develop and implement vision. In *Winning the Next War*, Stephen Rosen explains that peacetime military innovation is most likely when senior

military leaders develop a new theory of victory and then create "a new promotion pathway to the senior ranks, so that young officers learning and practicing the new way of war can rise to the top, as part of a generational change."⁵⁰ There is much the Air Force can do on the space front at both the junior and senior levels to help encourage the type of long-term innovation Rosen discusses.⁵¹ The Air Force should develop promotion pathways so that junior space officers can rise to senior levels of command, not only within the space community but also—and this will be one of the best tests of whether AI is rhetoric or reality—within the air community as well. The Air Force's ongoing Developing Aerospace Leaders Program is exploring ways to create these types of promotion pathways.

At the senior levels, the Air Force's greatest need is for more stability and longer tenures. By design, a great deal of turnover normally occurs in senior military positions, but certain key positions such as CINCSpace need to be broken out of this pattern in order to create more stability and long-term vision in an area in which these are so sorely lacking. There have already been eight CINCSpaces in the 15 years of USSPACECOM's existence, and this type of rotating door at the top makes it virtually impossible for anyone to provide long-term leadership and stable vision for the future.⁵² Of the eight, only two (Gen Robert T. Herres and Gen Donald J. Kutyna) had any significant space background prior to becoming CINCSpace, further aggravating the effects of rapid succession in command. It is particularly telling to contrast the plight of each CINCSpace to date with the long-term tenure enjoyed by Adm William Moffett and Adm Hyman Rickover as they nurtured naval aviation and nuclear propulsion—the United States Navy's most important innovations during the twentieth century.

Finally, and perhaps most importantly, we reiterate the importance of focusing on the first-order issue of developing a robust and comprehensive vision for United States space power rather than becoming mired in premature debates over the second-order issue

of how to organize the management of national security space. As we have argued throughout this article, any road will get you there when you don't know where you're going; a more effective and better funded organization will only get you lost faster in these situations. Limited resources are always a problem, and although there is a clear need for much greater investment in some areas such as launch and space surveillance, simply throwing more money at the Air Force (or a new space service, for that matter) will not resolve America's unclear vision for its national security space program.⁵³

Ultimately, the problem facing the Air Force comes down in large part to issues of perception and trust. Creating commissions and mandating organizational changes in order to address underlying issues are what politicians in pluralist democracies do when they do not trust bureaucracies to promote and implement change on their own. In

order to retain its responsibilities in space, the Air Force must not only *be* a good steward of space but must be *seen* to be a good steward. All the recommendations presented here address this challenge. Greater intellectual honesty and openness in discussions of strategy, greater coherence and rigor in the resulting vision statements and other public rhetoric, and greater efforts to develop knowledgeable and enduring military space leadership at all levels could do much to build faith in the Air Force's management of space. Without improvement in these areas, progress in space-power thought, the organizational health of the Air Force, and US national security will all suffer. But with such changes, the Air Force could establish itself as the champion of space-power transformation and in the process, avert future crises of congressional and the public's lack of confidence in its stewardship of space. □

Notes

1. Michael J. Neufeld, *The Rocket and the Reich: Peenemünde and the Coming of the Ballistic Missile Era* (New York: Free Press, 1995). Nazi Germany's rocket program and the Anglo-American Manhattan Project were both, in part, driven by reciprocal fears that the other side would gain a decisive military advantage by developing these technologies, and each program imposed a roughly equivalent burden on the economies of the Third Reich and the United States. This raises what Neufeld terms the "central paradox of Peenemünde"—the question of why their rocket program was such an unproductive military investment for the Nazis but so valuable to everyone else after the war.

2. Walter A. McDougall's Pulitzer prize-winning . . . *the Heavens and the Earth: A Political History of the Space Age* (New York: Basic Books, 1985) is the best comprehensive history of the complex political maneuvering by the superpowers at the opening of the space age. The best analysis of why President Kennedy chose to challenge the Soviets to a Moon race in 1961 remains John M. Logsdon's *The Decision to Go to the Moon: Project Apollo and the National Interest* (Cambridge, Mass.: MIT Press, 1970).

3. The most important previous committees and their key space-policy recommendations include the following: the 1954–55 Technological Capabilities Panel (TCP) (establish the legality of overflight and develop spy satellites); the President's Science Advisory Committee (PSAC), led by Science Advisor James Killian in 1958 (create NASA); the group led by Science Advisor George Kistiakowsky in 1960 (create the NRO); the review led by Vice President Lyndon Johnson in April 1961 (race the Soviets to the Moon for prestige); Vice President Spiro Agnew's 1969 Space Task Group (establish NASA's post-Apollo

goals); the Air Force's 1988 Blue Ribbon Panel led by Maj Gen Robert Todd (integrate space power into combat operations); NASA's 1991 Augustine Commission (emphasize scientific exploration over shuttle operations); and the Air Force's 1992 Blue Ribbon Panel, led by Lt Gen Thomas Moorman (emphasize space support to the war fighter and establish the Space Warfare Center).

The Space Commission was chaired by Secretary of Defense Donald Rumsfeld and included 12 other members with a broad range of very high-level military space expertise (listed with the top "space" job formerly held): Duane Andrews (deputy undersecretary of defense for command, control, communications, and intelligence); Robert Davis (undersecretary of defense for space); Howell Estes (commander, US Space Command); Ronald Fogleman (Air Force chief of staff); Jay Garner (commander, Army Space and Strategic Defense Command); William Graham (president's science advisor); Charles Horner (commander, US Space Command); David Jeremiah (vice chairman of the Joint Chiefs of Staff); Thomas Moorman (Air Force vice chief of staff); Douglass Necessary (House Armed Services Committee staff); Glenn Otis (commander, Army Training and Doctrine Command); and Malcolm Wallop (senator). See John A. Tirpak, "The Fight for Space," *Air Force Magazine* 83 (August 2000): 61.

The legislation authorizing the commission was clearly action-oriented and spelled out its duties as follows:

The Commission shall, concerning changes to be implemented over the near-term, medium-term, and long-term that would strengthen United States national security, as

sess the following: (1) the manner in which military space assets may be exploited to provide support for United States military operations. (2) The current interagency coordination process regarding the operation of national security space assets, including identification of interoperability and communications issues. (3) The relationship between the intelligence and nonintelligence aspects of national security space (so-called "white space" and "black space"), and the potential costs and benefits of a partial or complete merger of the programs, projects, or activities that are differentiated by those two aspects. (4) The manner in which military space issues are addressed by professional military education institutions. (5) The potential costs and benefits of establishing any of the following: (A) An independent military department and service dedicated to the national security space mission. (B) A corps within the Air Force dedicated to the national security space mission. (C) A position of Assistant Secretary of Defense for Space within the Office of the Secretary of Defense. (D) A new major force program, or other budget mechanism, for managing national security space funding within the Department of Defense. (E) Any other change to the existing organizational structure of the Department of Defense for national security space management and organization.

See sec. 1622 of *National Defense Authorization Act for Fiscal Year 2000* (Public Law 106-65; 113 Statute 814; 10 *US Code* 111 note).

In October 2000, Congress added an amendment directing the commission to study

- (6) the advisability of—
 - (A) various actions to eliminate the de facto requirement that specified officers in the United States Space Command be flight rated that results from the dual assignment of officers to that command and to one or more other commands in positions in which officers are expressly required to be flight rated;
 - (B) the establishment of a requirement that, as a condition of the assignment of a general or flag officer to the United States Space Command, the officer have experience in space, missile, or information operations that was gained through either acquisition or operational experience; and
 - (C) rotating the command of the United States Space Command among the Armed Forces.

See sec. 1091, Additional Duties for Commission to Assess United States National Security Space Management and Organization; sec. 1622(a) of the *National Defense Authorization Act for Fiscal Year 2000* (Public Law 106-65; 113 Statute 814; 10 *US Code* 111 note).

There were two other major congressionally mandated space studies during 2000: A review of the National Imagery and Mapping Agency (NIMA), *The Information Edge: Imagery Intelligence and Geospatial Information in an Evolving National Security Environment* (Washington, D.C.: n.p., December 2000); and a review of the NRO, *The NRO at the Crossroads* (Washington, D.C.: National Commission for the review of the National Reconnaissance Office, 1 November 2000). All three reports are available on-line at <http://www.space.gov>.

4. The Air Force and the NRO are, by far, the largest national security space organizations. By contributing 90 percent of space personnel, 85 percent of the space budget, 86 percent of space assets, and 90 percent of space infrastructure, the Air Force clearly "fields the majority of . . . space capabilities within the Department of Defense." See Gen Michael E. Ryan and the Honorable F. Whitten Peters, *The Aerospace Force: Defending America in the 21st*

Century: A White Paper on Aerospace Integration (Washington, D.C.: Department of the Air Force, May 2000), 5.

5. Gen Michael E. Ryan and the Honorable F. Whitten Peters, *Global Vigilance, Reach & Power: America's Air Force Vision 2020* (Washington, D.C.: Department of the Air Force, June 2000).

6. Many have asked, "Where are the Alfred Mahans or Billy Mitchells for space?" because analysts and military space leaders have yet to develop a comprehensive space-power vision or theory as compelling as President Eisenhower's. In 1997, then-CINCSpace Howell M. Estes III attempted to tackle this problem by commissioning Dr. Brian R. Sullivan to write a book on space-power theory. This project was taken over by James Oberg and published as *Space Power Theory* (Washington, D.C.: Government Printing Office, 1999). On the enduring nature of strategy and problems with developing space-power theory, see also Colin S. Gray and John B. Shelton, "Spacepower and the Revolution in Military Affairs: A Glass Half-Full," in *Spacepower for a New Millennium: Space and U.S. National Security*, ed. Peter L. Hays et al. (New York: McGraw-Hill, 2000), 239-58; and Colin S. Gray, *Modern Strategy* (Oxford: Oxford University Press, 1999), 243-67.

7. Gen Henry H. Arnold, "Air Power and the Future: Third Report to the Secretary of War by the Commanding General of the Army Air Forces," 12 November 1945, in *The Impact of Air Power: National Security and World Politics* by Eugene M. Emme (Princeton, N.J.: D. Van Nostrand, 1959), 306-10; and Theodore von Kármán, *Toward New Horizons: A Report to General of the Army H. H. Arnold, Submitted on Behalf of the A.A.A. Scientific Advisory Group* (Wright Field, Dayton, Ohio: Air Materiel Command Publications Branch, Intelligence, T-2, 15 December 1945). For an outstanding, highly detailed analysis of the roots of the aerospace concept, see Maj Stephen M. Rothstein, "Dead on Arrival? The Development of the Aerospace Concept, 1944-1958" (master's thesis, School of Advanced Airpower Studies, Maxwell AFB, Ala., June 1999).

8. *Preliminary Design of an Experimental World-Circling Spaceship*, Report no. SM-11827 (2 May 1946; reprint, Santa Monica, Calif.: RAND, 1998).

9. Lt Col Frank W. Jennings, "Doctrinal Conflict over the Word *Aerospace*," *Airpower Journal* 4, no. 3 (Fall 1990): 46-58.

10. Lt Col Paul L. Bailey, "Space as an Area of Responsibility," *Air Chronicles*, Winter 1998, on-line, Internet 13 December 2000, available from <http://www.airpower.maxwell.af.mil/airchronicles/apj/apj98/win98/waywin98.html>.

11. Department of Defense Directive 3100.10, *Space Policy*, 9 July 1999.

12. McDougall was the first to break through the veil of secrecy surrounding America's early space policy. The term *stalking horse* is taken from R. Cargill Hall's "Origins of U.S. Space Policy: Eisenhower, Open Skies, and Freedom of Space," in *Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program*, ed. John M. Logsdon, vol. 1, *Organizing for Exploration* (Washington, D.C.: NASA History Office, 1995), 213-29.

13. For more detail on the disconnects between what the Air Force wanted to do in space and what it was allowed to do during this period, see Peter L. Hays, "Struggling towards Space Doctrine: U.S. Military Plans, Programs, and Perspectives during the Cold War" (PhD diss., Fletcher School of Law and Diplomacy, Tufts University, May 1994), 96-302; and David N. Spires, *Beyond Horizons: A Half Century of Air Force Space Leadership* (Peterson AFB, Colo.: Air Force Space Command, 1997), 50-173. The most comprehensive analysis of the Dyna-Soar Program is Roy Franklin Houchin II's "The Rise and Fall of Dyna-Soar: A History of Air Force Hypersonic Research and Development, 1944-1963" (PhD diss., Auburn University, May 1995).

14. The Air Force's latest space doctrine describes the attributes of space power as global coverage, flexibility, economy, effectiveness, and robustness. See Air Force Doctrine Document 2-2, *Space Operations*, 23 August 1998, 15-18. Keith Hall, assistant

secretary of the Air Force for space and director of the NRO, recently explained the main attributes of space forces as perspective, persistence, penetration, precision, reliability, and speed. Presentation to the "Space 2000" Conference, American Institute of Aeronautics and Astronautics, Long Beach, Calif., 19 September 2000.

15. Lt Col Dennis M. Drew, "Of Leaves and Trees: A New View of Doctrine," *Air University Review* 33, no. 2 (January–February 1982): 40–48; Lt Col Charles D. Friedenstien, "The Uniqueness of Space Doctrine," *Air University Review* 37, no. 1 (November–December 1985): 13–23; and Col Kenneth A. Myers and Lt Col John G. Tockston, "Real Tenets of Military Space Doctrine," *Airpower Journal* 2, no. 4 (Winter 1988): 54–68.

16. The Air Force published AFM 1-6 on 15 October 1982, and its release was designed to coincide closely with the stand-up of Air Force Space Command on 1 September 1982. For a detailed critique of AFM 1-6, see Hays, "Struggling towards Space Doctrine," 400–422.

17. Friedenstien, 21, 22.

18. Myers and Tockston, 59. A more up-to-date and outstanding blueprint for developing space doctrine is provided by Maj Robert D. Newberry, *Space Doctrine for the Twenty-First Century* (Maxwell AFB, Ala.: Air University Press, October 1998).

19. Gen Thomas S. Moorman Jr., "The Air Force in Space, Its Past and Future," in *The U.S. Air Force in Space: 1945 to the Twenty-First Century*, ed. R. Cargill Hall and Jacob Neufeld (Washington, D.C.: USAF History and Museums Program, 1998), 174.

20. Ibid.

21. Gen Ronald R. Fogleman and the Honorable Sheila E. Widnall, *Global Engagement: A Vision for the 21st Century Air Force* (Washington, D.C.: Department of the Air Force, November 1996), 8. Another candidate as the Air Force's most strident statement regarding space used to adorn the wall in the entryway of Headquarters Air Force Space Command (before the building was dedicated to the late Gen James V. Hartinger): "Spacepower will be as decisive in future combat as airpower is today," Gen Larry D. Walsh and Secretary E. C. Aldridge Jr., *Air Force Space Policy* (Washington, D.C.: Department of the Air Force, 2 December 1988).

22. See, for example, Sen. Bob Smith, "The Challenge of Space Power," *Airpower Journal* 13, no. 1 (Spring 1999): 34–35.

23. Maj Gen John L. Barry and Col Darrell L. Herriges, "Aerospace Integration, Not Separation," *Aerospace Power Journal* 14, no. 2 (Summer 2000): 44. Aerospace enthusiasts often fail as well to acknowledge that military operations in the suborbital aerospace region are unlikely to be more than a useful but relatively minor adjunct to air and space operations due to the unfavorable physical characteristics of the realm.

24. However, Maj Bruce M. DeBlois, "Ascendant Realms: Characteristics of Airpower and Space Power," in *The Paths of Heaven: The Evolution of Airpower Theory*, ed. Col Phillip S. Meilinger (Maxwell AFB, Ala.: Air University Press, 1997), 529–78, does so without neglecting strategic variables.

25. For a more detailed discussion, see Karl Mueller, "The Phantom Menace: Assessing Threats to American Interests in Space" (paper presented at the American Political Science Association Annual Meeting, Atlanta, Ga., 4 September 1999). For an outstanding analysis of trigger events that might lead to weaponization of space and a very interesting analogy between space and railroads, see Barry D. Watts, *The Military Uses of Space: A Diagnostic Assessment* (Washington, D.C.: Center for Strategic and Budgetary Assessments, forthcoming).

26. Smith, 33.

27. Prominent examples include the USAF Scientific Advisory Board's *New World Vistas: Air and Space Power for the 21st Century: Space Applications Volume* (Washington, D.C.: USAF Scientific Advisory Board, 1995), 164. See also the summary of the study in

Peter Grier, "The Arena of Space," *Air Force Magazine*, September 1996, 44–46.

28. Ashton Carter discusses this as "the paradox of ASAT arms control." See "Satellites and Anti-Satellites: The Limits of the Possible," *International Security* 10 (Spring 1986): 46–98.

29. Joseph S. Nye Jr. and James A. Schear, eds., *Seeking Stability in Space: Anti-Satellite Weapons and the Evolving Space Regime* (Lanham, Md.: University Press of America and Aspen Strategy Group, 1987); David W. Ziegler, *Safe Heavens: Military Strategy and Space Sanctuary Thought* (Maxwell AFB, Ala.: Air University Press, 1998), reprinted in *Beyond the Paths of Heaven: The Emergence of Space Power Thought: A Comprehensive Anthology of Space-Related Master's Research*, ed. Col Bruce M. DeBlois (Maxwell AFB, Ala.: Air University Press, 1999); Karl Mueller, "Space Weapons and U.S. Security," *Security Studies* (forthcoming); and Charles S. Robb, "Star Wars II," *The Washington Quarterly* 221 (Winter 1999): 81–86.

30. See especially William L. Spacy II, *Does the United States Need Space-Based Weapons?* (Maxwell AFB, Ala.: Air University Press, 1999).

31. William B. Scott, "USSC Prepares for Future Combat Missions in Space," *Aviation Week & Space Technology*, 5 August 1996, 51; and Gen Howell M. Estes III, speech to the Air Force Association Annual Symposium, Los Angeles, Calif., 18 October 1996. See also Thomas D. Bell, *Weaponization of Space: Understanding Strategic and Technological Inevitabilities* (Maxwell AFB, Ala.: Center for Strategy and Technology, Air War College, January 1999).

32. The inappropriateness of using the airpower-development analogy to analyze the development of space power is a primary finding of Hays, "Struggling towards Space Doctrine."

33. There is no consensus on what constitutes a "space weapon." For example, the Air Force insisted for many years that ICBMs were not space weapons even though they travel through space en route to their targets—and then implicitly reversed that position after transferring its missile forces from Strategic Air Command to Air Force Space Command in 1993. Modern space systems that provide real-time information directly to war fighters or dynamically retarget GPS-enabled munitions are further eroding any clear lines for defining space weapons. The most comprehensive history of ASATs is Paul B. Stares's *The Militarization of Space: U.S. Policy, 1945–84* (Ithaca, N.Y.: Cornell University Press, 1985). On the ultimately unsuccessful arms-control efforts to roll back the weaponization of the air during the interwar period, see Phillip S. Meilinger, "Clipping the Bomber's Wings: The Geneva Disarmament Conference and the Royal Air Force, 1932–1934," *War in History* 6 (July 1999): 306–30.

34. On the importance of the sea change caused by the burgeoning commercial space sector, see Frank G. Klotz, *Space, Commerce, and National Security* (New York: Council on Foreign Relations Press, 1998); Gen Thomas S. Moorman Jr., "The Explosion of Commercial Space and the Implications for National Security," *Airpower Journal* 13, no. 1 (Spring 1999): 6–20; and John M. Logsdon and Russell J. Acker, eds., *Merchants and Guardians: Balancing U.S. Interests in Global Space Commerce* (Washington, D.C.: Space Policy Institute, George Washington University, May 1999). The development of truly inexpensive access to space would create incentives for new types of commercial space activity such as space tourism.

35. Of course, it is always worth recalling that terrorism by or against states is very uncommon and that countless potential targets that are economically valuable and even more vulnerable are never attacked, making it a bit unclear why enemies would choose to attack space systems in particular.

36. See Robert B. Giffen, *U.S. Space System Survivability: Strategic Alternatives for the 1990s* (Washington, D.C.: National Defense University Press, 1982); Ziegler, *Safe Heavens*; and Matt Bille, Robyn Kane, and Maj Mel Nowland, "Military Microsatellites: Matching Requirements and Technology" (paper presented at the Space 2000 Conference and Exposition, American Institute

of Aeronautics and Astronautics, Long Beach, Calif., 19–21 September 2000).

37. See, for example, Lt Gen Bruce Carlson, "Protecting Global Utilities," *Aerospace Power Journal* 14, no. 2 (Summer 2000): 37–41. For a more detailed development of this argument with a focus on distinctions between the role of armies and navies, see Brig Gen Simon P. Worden, "Space Control for the 21st Century: A Space 'Navy' Protecting the Basis of America's Wealth," in Hays et al., *Spacepower for a New Millennium*, 225–38.

38. See, for example, Yahya A. Dehqanzada and Ann M. Florini, *Secrets for Sale: How Commercial Satellite Imagery Will Change the World* (Washington, D.C.: Carnegie Endowment for International Peace, 2000); and Lt Col Larry K. Grundhauser, "Sentinels Rising: Commercial High-Resolution Satellite Imagery and Its Implications for US National Security," *Airpower Journal* 12, no. 4 (Winter 1998): 61–80.

39. USSPACECOM became responsible for CND in 1999 and picked up the CNA mission on 1 October 2000. It is currently quite unclear, however, how the command will organize to perform these new missions. Apparently, one of the leading contenders is a unified subcommand for both CND and CNA, but this option, along with several others, is the subject of a comprehensive study set for completion by 1 October 2001. See George I. Seffers, "Cyberwar Ops May Unify," *Federal Computer Week*, 30 October 2000, 12.

40. Barry and Herriges, 42–43.

41. Barry and Herriges, for example, assert that space belongs in the Air Force because although all the services depend heavily on space support, only the Air Force plans to migrate some of its key functions there. *Ibid.*, 46. They do not address the resulting implication that if the Army or Navy rewrote its vision statements to place greater emphasis on space and committed itself to shifting key functions such as fire support or sea control to space platforms, the Air Force would lose its claim to being the natural home of military space operations.

42. *Ibid.*, 45.

43. Ralph Millsap and Dr. D. B. Posey, "Organizational Options for the Future Aerospace Force," *Aerospace Power Journal* 14, no. 2 (Summer 2000): 48.

44. Smith, 33–35.

45. Quoted in William B. Scott, "Cincspace: Focus More on Space Control," *Aviation Week & Space Technology*, 13 November 2000, 80.

46. Lt Col Cynthia A. S. McKinley, "The Guardians of Space: Organizing America's Space Assets for the Twenty-First Century," *Aerospace Power Journal* 14, no. 1 (Spring 2000): 37–45.

47. Although some critics (e.g., Col Darrell L. Herriges, "US Space Guard? No Thank You!" *Aerospace Power Journal* 14, no. 2 [Summer 2000]: 53) have misunderstood McKinley's somewhat ambiguous discussion of space control to imply shifting this mission entirely to the quasi-military Space Guard, she clearly advocates retaining ASAT capabilities such as the Space Operations Vehicle in the hands of the Air Force. See McKinley, 39, 44.

48. See Robert L. Butterworth, "The Case against Centralizing Military Space," *Strategic Review* 24 (Summer 1996): 41–49.

49. William Mitchell, *Winged Defense* (New York: G. P. Putnam's Sons, 1925); and Robert T. Finney, *History of the Air Corps Tactical School, 1920–1940* (1992; reprint, Washington, D.C.: Center for Air Force History, 1955). See also the essays by Lt Col Mark A. Clodfelter, "Molding Airpower Convictions: Development and Legacy of William Mitchell's Strategic Thought," and Lt Col Peter R. Faber, "Interwar US Army Aviation and the Air Corps Tactical School: Incubators of American Airpower," in Meilinger, *Paths of Heaven*, 79–114 and 183–238, respectively.

50. Stephen Peter Rosen, *Winning the Next War: Innovation and the Modern Military* (Ithaca, N.Y.: Cornell University Press, 1991), 20. For a very interesting and more comprehensive model for military innovation, see Maj Bruce McClintock, "The Transformation Trinity: The Role of Vision, Culture, and Assessment in Strategic Innovation" (master's thesis, School of Advanced Airpower Studies, Maxwell AFB, Ala., June 2000).

51. It is currently impossible to assess how much needs to be done in this area, however, as the Air Force categorically refuses to release information about promotion rates for officers in the space career field, even to researchers within the service. See McClintock, 56–57. This policy raises the question of what's being hidden and casts serious doubt upon the Air Force's current commitment to make such changes. Another personnel policy, the recent change to fill the position of CINCSpace with officers eligible to compete for further assignments rather than being on their terminal assignment, seems likely to further restrict the leadership autonomy of those who wear the three hats in Colorado Springs.

52. The top recommendation of Adm Hal Gehman, the recently retired CINC of Joint Forces Command (JFC), was for future JFC CINCs to serve longer terms in order to create a corps of dedicated experimental forces and implement transformation. Robert Holzer, "Stability at Top Is Critical to JFC's Pentagon Clout," *Defense News*, 4 September 2000, 1.

53. See E. C. "Pete" Aldridge, "Vision for Military Space: Roadmap Proposes Foundation for Space Defense," *Defense News*, 20 November 2000, 30.

Maneuvers are threats; he who appears most threatening wins.

—Ardant du Picq, 1821–70